

ABSTRACT

A plasma-assisted deposition system for carrying out a plasma-assisted deposition method has a processing vessel defining a vacuum chamber and having an open upper end, a dielectric member covering the open upper end of the processing vessel, and a flat antenna member placed on the upper surface of the dielectric member. A coaxial waveguide has one end connected to the upper surface of the flat antenna member and the other end connected to a microwave generator. The flat antenna member is provided with many slots of a length corresponding to half the wavelength of a microwave arranged on concentric circles. For example, a circularly polarized microwave is radiated from the slots into a processing space to produce a source gas plasma. Electron temperature in the plasma in terms of mean square velocity is 3 eV or below and the electron density in the plasma is 5×10^{11} electrons per cubic centimeter or above. The plasma is used for depositing a fluorine-containing carbon film. Preferably, the process pressure is 19.95 Pa or below. Under such process conditions for depositing a fluorine-containing carbon film by using the plasma, the source gas, such as C_5F_8 gas, is decomposed properly to form a structure of long CF chains. A interlayer insulation film thus formed has a small relative dielectric constant and permits only a low leakage current.